The One-Third Multiband Antenna

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Pete, OH1NE, has had many inquiries about his multi-band antenna. It is a dipole, fed by an untuned feeder for operation on 3.5 and 7 mc. While designed for 3.5 and 7 it also functions nicely on 14 and 21 mc.

A GREAT deal of my short ham career has been spent among the pines in raising and lowering various multiband dipoles. My purpose has been to find a multiband wire, fed with untuned feeders, which would give good results on 3.5 and 7 mc, and if possible, on other bands. My main interest is c.w.

After having tried most known multiband dipoles, I sat down—and came up with an idea.

Theory

A 3.5 mc halfwave dipole, as you know, resonates on all of our h.f. bands. However, the impedance on 3.5 is low; 20-100 ohms, depending upon the height. On other bands it is high; in the neighborhood of 1000 ohms. The problem is thus: how to feed it? I solved the problem this way:

If we take this doublet and connect a 3.5 mc quarterwave open stub at the feedpoint and then draw the current distribution curves of the antenna and the stub (fig. 1.) we find that the

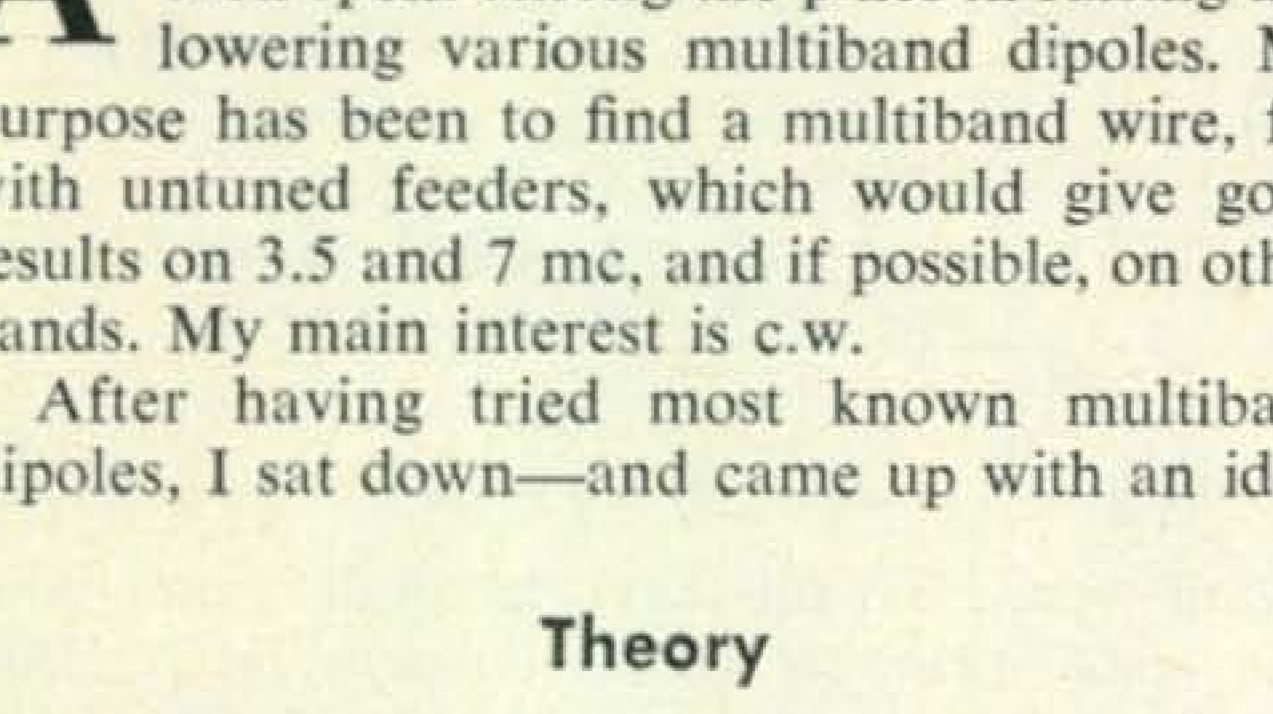

Fig. 1—Current distribution on the antenna and stub for 3.5 and 7 mc. Point C, ⅓ of A to D, will have approximately the same impedance for both bands.

impedance at point A is low at 3.5 mc and high at 7 mc. At point B it is medium high at 3.5 mc and low at 7mc. Somewhere between A and B the impedance at 3.5 and 7 mc must be equal. If we connect the feeder at point C (AC = AD/3), the feedpoint in the stub is one third of a quarter-wave away from current maximum on 3.5, 7, 14, and 28 mc. The impedances should be about the same on these bands (fig. 2).

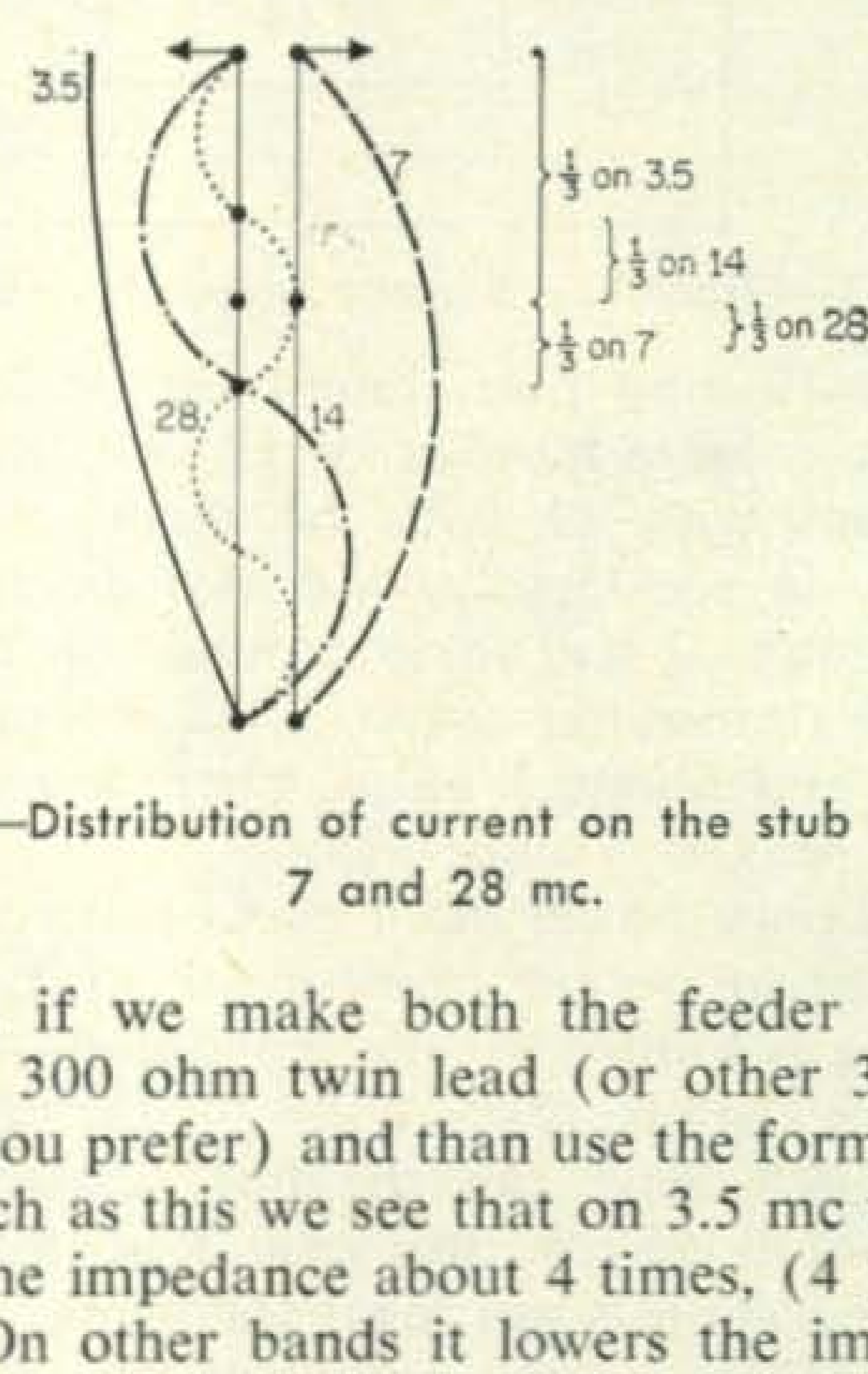

Fig. 2—Distribution of current on the stub for 3.5, 7 and 28 mc.

Also, if we make both the feeder and the stub of 300 ohm twin lead (or other 300 ohm line if you prefer) and than use the formula of a stub such as this we see that on 3.5 mc this stub raises the impedance about 4 times, ($4 \times 70 = 280$). On other bands it lowers the impedance about 4 times, ($1000/4 = 250$). Thus, we get a very good impedance match to a 300 ohm feeder on the 3.5, 7, 14, and 28 mc bands.

This "one-third-idea" has appeared previously but the theory describing it was unorthodox.

On 21 mc the stub doesn't change the impedance and we thus feed a 1000 ohm antenna with 300 ohm feeder. The s.w.r. is rather high, but this antenna is usable on 21 mc.

Measurements

I have measured the s.w.r. of this antenna to be as shown in fig. 3. The measurements were made using a bridge arrangement. It can be seen that the losses in the feeder are very small on the 3.5 and 7 mc c.w. bands and not too high on other bands. On 21 mc the curve is a bit better than it should be. I don't know why. The end effect moves the resonance point to the 'phone segment on higher bands.

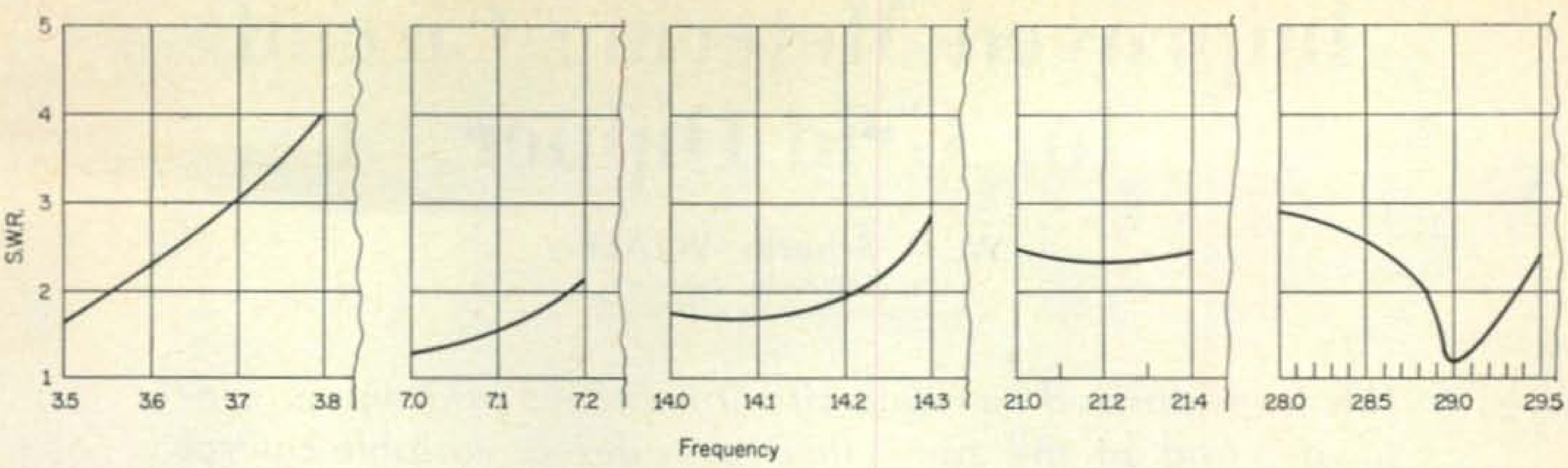

Fig. 3—S.w.r. versus frequency for each band.

On-The-Air Results

This antenna has been in use for some time now and I'm rather satisfied with the reports I have received. According to the reports, this antenna is as good on 3.5 mc as a normal halfwave dipole. On 7 mc this new antenna is the best wire antenna I have had; especially on long hauls. This is probably due to the directional characterisitics of this antenna; two halfwaves in phase. On 14 mc the same can be said as on 3.5. On 21 mc the s.w.r. is rather high, but I have received some nice S9 reports for my 20 watts on this band also. Ten has been dead every time I have tried.

Well, the theory appears to work out, the measurements are good, and the reports I've obtained are good. I hope I don't need to do any more climbing for a while.

Construction

The length of the dipole is 134 feet. The stub and the feeder in my antenna are made of 300 ohm flat twinlead. The length of the stub is 58 feet.

If you wish, you may build a more durable antenna using 300 ohm open wire line or 300 ohm steelconductor twinlead. Use your grid dipper for measuring the quarter wave stub in this case.

The "tail" of the stub (fig. 4) can be left hanging down as in (A), tied under the feeder as in (B), or folded together at the feedpoint, (C). Don't fold it too tightly.

In some cases it may happen that the stub alone will be long enough to reach the rig, and I think that this system is reasonable then as an automatic matching system. You don't need an antenna tuner; a saving in money and a saving in time.

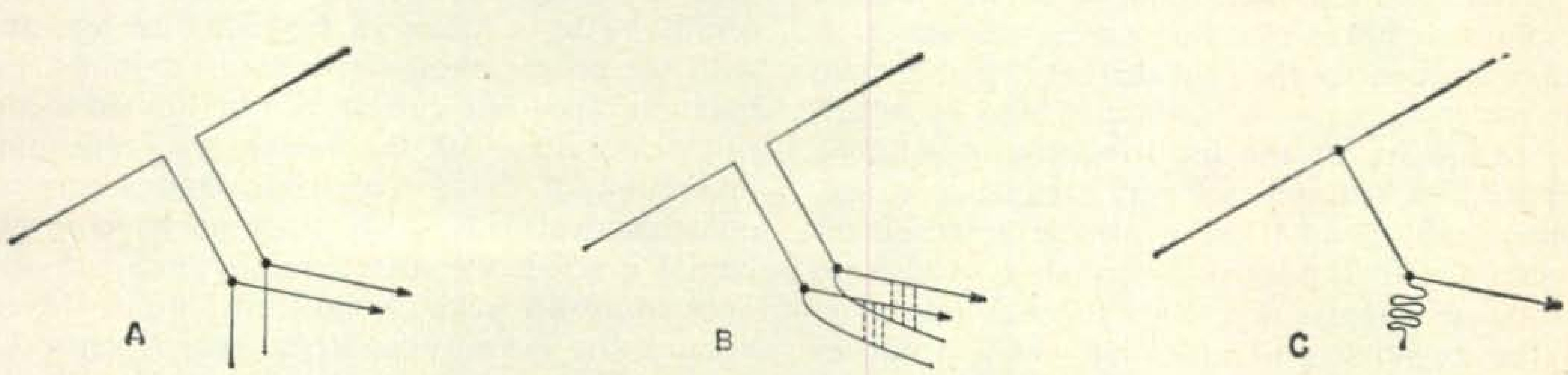

Fig. 4—Three methods of handling the open stub.

Other Versions

If you are short of space and want to work 80 and 40 you can bend about 20 feet down on each side with little effect on the signal strength. If you don't want the directional characteristics you can set the antenna legs at right angles to each other. If you omit 80 you can make your copy in ½ scale. It will be good on 7, 14, and 28 mc and I know it will also work on 21 as I have tried. In this case you can bend it 10 feet at both ends, if necessary.

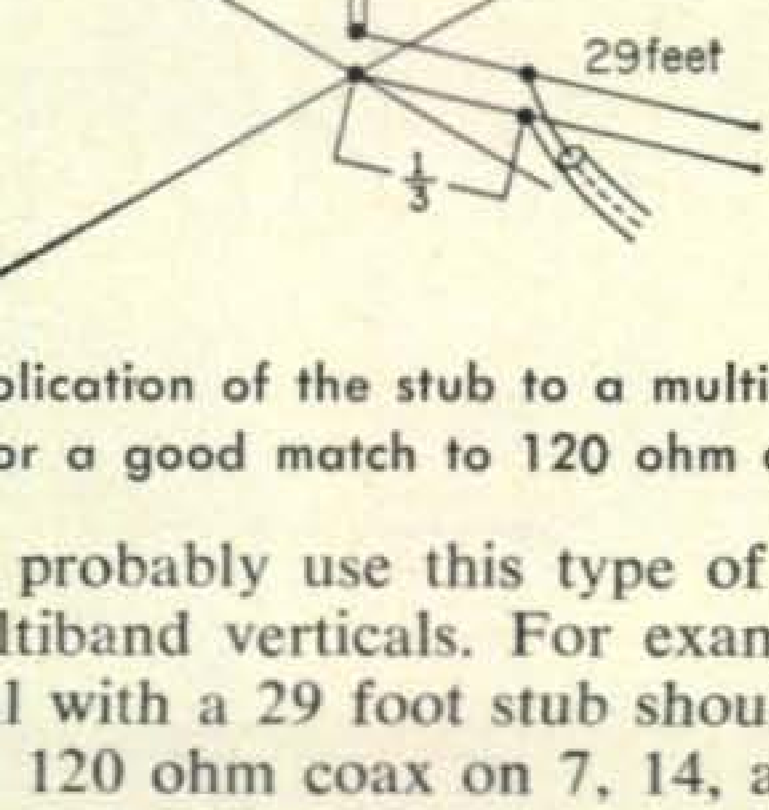

Fig. 5—Application of the stub to a multiband vertical for a good match to 120 ohm coax.

One can probably use this type of matching also in multiband verticals. For example, a 33 foot vertical with a 29 foot stub should be well matched to 120 ohm coax on 7, 14, and 28 mc and should work on 21 mc (fig. 5). Also, I guess you could use a dipole of this type as the radiating element in a multiband beam. This is conjecture as I have not tried this yet. ■